the author of this book, while the project is still under discussion in this country. The chair being established, the need of a text-book has been immediately felt and M. Gavrian has met the want by his excellent book.

The first point that strikes one is that the author does not assume previous knowledge of the subject but begins by a discussion of the conditions to be satisfied and the materials which are available, but it is obvious that he expects the student to have a working acquaintance with chemistry, physics and elementary engineering.

The consideration of the action of vehicles on the road surface and *vice versa* is clear and concise; it deserves to be well considered by every one who is interested in the road problem as there is much confusion and uncertainty on this aspect of the problem.

Another section worthy of every commendation is the chapter devoted to definitions and nomenclature. The application of the same or similar names to different substances and compounds in England, France and America has led and can only lead to misapprehensions and failure to take advantage of experience gained in other countries. It is gratifying to note that English nomenclature meets with his approval, and until a standard international nomenclature is established his summary of the differences will be most valuable. The second and third chapters are devoted to a description of the production and testing of tars, pitches and other binding materials, the latter of which is probably worthy of more careful attention than is always given to it, since some failures have undoubtedly been due to materials differing in composition and properties from those employed successfully elsewhere.

A discussion of the relative usefulness and suitability of various rocks and slags in combination with different binders would have been useful as a separate section, while the binder used in Rocmac deserves more space as it has advantages in certain situations probably not possessed in the same degree by other materials.

Considerable attention is given to the manner in which pot holes are formed and the obscure phenomena known as corrugation of road surfaces. No conclusion is put forward with regard to the latter, but the need for careful research is urged. It is probably not a simple problem and will resist resolution for some time as the related problem of the corrugation of steel rails subjected to electric traction has done although the conditions can be much more exactly determined in the latter case.

M. Gavrian has collected a considerable quantity of data on the tractive effort required on different types of road surface and for different types of tyres; this is all to the good as the publication of authoritative figures should do much to reconcile transport owners to the high cost of modern roads by showing that there is reduction in cost in another direction. The destructive effect of certain kinds of tyre is also well brought out and may help towards their elimination if it brings home to the vehicle owner that any slight advantage he may gain individually has to be paid for eventually in greater expenditure on the road itself.

A standard English text-book of this type would be of great assistance to the student not only of highway engineering but of general engineering also, as the subject is too often neglected.

Radio-Communication.

(1) *Die drahtlose Telegraphie und Telephonie.* Bearbeitet von Dr. P. Lertes. (Wissenschaftliche Forschungsberichte. Naturwissenschaftliche Reihe. Herausgegeben von Dr. R. Ed. Liesegang. Band IV.) Pp. xi+152. (Dresden und Leipzig: T. Steinkopff, 1922.) 4*s.*

(2) *Marine Wireless Pocket Book for the Practical Operator and Student.* By W. H. Marchant. Pp. vii+180. (London: Sir I. Pitman and Sons, Ltd., 1922.) 6*s.* net.

(3) *Continuous Wave Wireless Telegraphy: A Non-Mathematical Introduction to the Subject of Wireless Telegraphy from the Engineer's Point of View.* By B. E. G. Mittell. (Pitman's Technical Primer Series.) Pp. xvi+114. (London: Sir Isaac Pitman and Sons, Ltd., 1922.) 2*s.* 6*d.* net.

THE development of the art of radio-communication has been so rapid that much of the apparatus described in technical books on the subject is either obsolete or is very little used. Its inclusion, however, may be justified on the ground that it is wanted by students for examinational purposes. As the number of books on the subject is large and is rapidly increasing, the expert who reads them all will naturally weary of going over the same ground so often.

(1) Dr. Lertes's book will be of value as a work of reference. The descriptions are much too brief to be followed by any one who is not thoroughly familiar with the subject. A wealth of references are given which will be useful to any one who is making a special research on some branch of the subject. It would, however, be a help to the reader if the references were subdivided under various headings such as mathematical, physical, technical, and commercial. The ground covered is very wide and an account of the Johnsen and Rahbek electrostatic relay is included.

(2) This pocket book is intended principally for the

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marine radio-telegraphist. Detailed instructions are given as to the methods of adjusting the various standard Marconi sets. Descriptions are also given of the apparatus of the Telefunken and Radio-Communication Co. The diagrams are very clear and the tables, rules, instructions, etc., included have been well selected.

(3) As the bulk of the world's radio-communication is carried on by continuous wave (C.W.) systems, it is natural that there should be a demand for elementary but accurate descriptions of these systems. The number of C.W. arc stations now exceeds a thousand, and more than 10,000 kilowatts have been installed for their operation. There are also many high frequency and valve generator stations. As space is limited in this booklet, some of the descriptions of important methods are too brief to be of much help to the reader, and there are notable omissions. The chapters on the advance of the C.W. system and on the Poulsen arc are instructive and contain novel matter. We can commend the book.

Plant Morphology and Physiology.

Practical Plant Biology: A Course of Elementary Lectures on the General Morphology and Physiology of Plants. By Prof. H. H. Dixon. Pp. xi+291. (London: Longmans, Green and Co., 1922.) 6*s*.

A TEXT-BOOK by such an experienced teacher as Prof. H. H. Dixon is very welcome. To judge from the introduction, this book represents in condensed form the series of lectures which the author has found most suitable for the introduction of his subject to a class in which medical students predominate. At the end of each lecture brief notes are added as to the scope of the practical work to be carried out in conjunction with the course. Each lecture occupies on the average about eight pages, and in the thirty lectures a wide series of types are covered, from unicellular forms to the flowering plant. Considerable physiological work is included, and the subjects of nuclear division, heredity, and evolution occupy the last three lectures. The treatment is therefore of necessity much condensed, and an elementary student would find it difficult to use the book except under guidance.

Three salient features in the book have impressed the present reviewer. The first is the interest and charm with which the author's style and personality invests the subjects of the elementary course. It is clear that each time Prof. Dixon renews his acquaintance with these familiar plants, his class will find him filled with the enthusiasm of a first encounter. The student cannot forget that he is studying living plants, even when examined in the remote region of a "microscopic field." With the aid of a "ghost micrometer," an instrument Prof. Dixon demonstrated to Section K of the British Association for the Advancement of Science at Edinburgh last year, comparative data as to size, rate of movement, etc., are always kept before the student. The brief instructions given on p. 74 for practical work with Spirogyra provide an excellent example of how to make a student realise that Spirogyra is a living object in a three-dimensional world, and not a design transferred from the plane of the microscopic image to the plane of the paper. The second striking point is that the author has found it advisable to build up a knowledge of the plant by progress from the simpler unicellular forms to the more complex vascular plants. The initial difficulty of the unfamiliarity of the plant forms thus first introduced to the student is grappled with most successfully, and very interesting use is made of the opportunity thus provided, at an early stage of the course, of indicating the great practical and human significance of biological studies. On the other hand, this method of approach appears to make the treatment of plant physiology more disconnected and less experimental. Photosynthesis appears fairly early in the course, but the experimental treatment at this stage does not encourage any effort to associate the process with gain in dry weight and in carbon content. Respiration is discussed first as an anaerobic process with yeast, and later is treated more generally under Chlamydomonas. While some general questions as to the water relations of the cell appear in Lecture II., root pressure and translocation, hinted at in Lecture XIX. on the fern, are not fully treated until Lecture XXV.

Coming to the third point of interest, as might be anticipated from the author, a much wider use is made of relatively complex data from physics and chemistry than is usual in an elementary botanical text-book. If botany is to progress this seems to be an essential development, even if it implies ultimately a recognition that elementary botany courses need building upon the physics and chemistry of the final years of the graduate science course! Lecture II. introduces us to diffusion and osmosis, Lecture III. to phenomena of the colloid state, Lecture IV. to enzyme action and surface phenomena in heterogeneous systems. This pace is rather sweeping and makes great demands upon the student. It is probably also inevitable that as botanists venture into these paths, the pioneers will stumble occasionally in their unfamiliar surroundings. The attempt to define the difference between a gel and a sol on p. 22 appears to be a case in point. The explanation here given of the structure of a gel would render the phenomena of diffusion in

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